

22-05-2000

PCT/GB99/01431

CLMS

P09165PC

-21-  
CLAIMS

1. A storage device (1) for a host computer system, the storage device comprising: storage means (2, 4, 5) for storing information; intelligent means (7) for controlling the transfer of information to and from the storage means; and interfacing means (6) for interfacing the storage device with the host computer system and via which information is transferred to and from the storage means under the control of said intelligent means,
- the storage means comprising: a storage medium (2) divided into a plurality of non-overlapping partitions including a boot partition and at least one general partition, each said partition being divided into a plurality of sectors, the boot partition including a boot sector containing code for use by the host computer system to perform operating system boot of the host computer system; non-volatile read-only-memory (ROM) means (4) for storing firmware for controlling operation of the storage device; and volatile random-access-memory (RAM) means (5);
- wherein supervising means is incorporated in said storage means for operating said intelligent means so as to protect information stored in the storage medium (2), said supervising means being incorporated at least partly as firmware which is stored in said non-volatile ROM means (4), and wherein the storage device further includes:
- a host executable code segment, stored in said storage means, for allowing user control of the supervising means via the host computer system and for controlling initiation of operating system boot in the host computer system; and loader means stored in the storage means and comprising host executable code for loading said code segment to the host computer system and causing the host computer system to execute the loaded code segment;
- and wherein said supervising firmware stored in the ROM means (4) is adapted to intercept any request for said boot sector,

AMENDED SHEET

22-05-2000

PCT/GB99/01431

CLMS

P09155PC

-22-

issued by the host computer system in use thereof, and to supply said loader means to the host computer system to satisfy the request.

5 2. A storage device according to claim 1, wherein the supervising means is provided wholly as firmware which is stored in said non-volatile ROM means (4) on the storage device (1).

10 3. A storage device according to claim 1 ~~or claim 2~~, wherein the intelligent means comprises a micro-controller (7) which runs the supervising firmware stored in the ROM means (4).

4. A storage device according to <sup>claim 1</sup> ~~any preceding claim~~, wherein  
15 the supervising means operates said intelligent means (7) so as to allow/restrict/prohibit read/write operations upon the storage medium (2) depending upon whether information to be read from a sector or written to a sector is operating system information or user information, whether the sector is in the  
20 boot partition or in a general partition, and whether if the partition is a general partition the partition is active or inactive.

5. A storage device according to claim 4, wherein the  
25 supervising means also ensures that firmware stored on the ROM means (4) of the storage device (1), which includes the supervisor firmware, is also protected in that a user, or a user program operating in the host computer system, does not have access to the ROM means (4) of the storage device itself.

30

6. A storage device according to <sup>claim 1</sup> ~~any preceding claim~~, wherein the supervising means is configured so as to cause a warning to be issued to the user should an attempt be made to perform a prohibited read, write or format operation.

35

AMENDED SHEET

22-05-2000

PCT/GB99/01431

CLMS

P091652C

-23- *claim 1*

7. A storage device according to ~~any preceding claim~~, wherein at least one of said partitions of the storage device (1) comprises a Write Many Recoverable (WMR) partition wherein, in use, if a write command is issued to overwrite any information 5 stored in the WMR partition the updated information is stored elsewhere on the storage medium (2), and a pointer to the updated information is provided so the updated information can be accessed as required during the remainder of the session, and wherein a system reset causes the pointer to the updated 10 information to be cleared.

8. A storage device according to claim 7, wherein the or each said WMR partition has a Sector Relocation Table (SRT) associated therewith which is held in said volatile RAM means 15 (5) of the storage device (1), and each entry in a said SRT is a pointer which defines the address of a range of sectors in the WMR partition that have been updated and an address where the updated information is located, this location being within a dedicated area on the storage medium (2) which is accessed 20 only by the supervisor means.

9. A storage device according to *claim 1* ~~any of claims 1 to 6~~, wherein at least one of said partitions of the storage device (1) comprises a Write Many Recoverable (WMR) partition wherein, in 25 use, if a write command is issued to overwrite any information stored in said at least one WMR partition, prior to undertaking said write command said information is copied and stored elsewhere on the storage medium (2) to be copied back to said WMR partition when required.

30

10. A storage device according to *claim 1* ~~any preceding claim~~, wherein the loader means is configured to load said code segment to a central processing unit (CPU) of the host computer system for execution by the host computer system prior to operating 35 system boot.

AMENDED SHEET

22-05-2000

PCT/GB99/01431

CLMS

P09165PC

-24-

11. A storage device according to claim 10, wherein the loader means is provided in said non-volatile ROM means (4) of the storage device (1).

5 12. A storage device according to claim 10, wherein said loader means is provided in a reserved area on the storage medium (2), which reserved area is inaccessible to a user or user program.

10 13. A storage device according to <sup>claim 10</sup> ~~any of claims 10 to 12~~, wherein the code segment is provided in said non-volatile ROM means (4) of the storage device.

14. A storage device according to <sup>claim 10</sup> ~~any of claims 12 to 14~~,  
15 wherein the code segment is provided in a reserved area of the storage medium (2) which is inaccessible to a user or user program, but is accessible to the supervising means, whereby unauthorised alteration of the code segment is prevented.

20 15. A storage device according to <sup>claim 1</sup> ~~any preceding claim~~, wherein said host executable code segment comprises code for enabling the storage device to be set in either "supervised" mode, in which the supervising means is active, or "unsupervised" mode in which the supervising means is not active.

25

16. A storage device according to claim 15, wherein said code segment, when executed, provides user prompts which allow a user to select said "supervised" mode, or by entry of a password select said "unsupervised" mode, and the code segment  
30 is constructed such that, subsequent to mode selection by the user, the code segment transfers a boot program from the boot sector of the storage medium (2) and causes the host computer system to execute said boot program so as to initiate operating system boot in the host computer system.

35

AMENDED SHEET

22-05-2000

PCT/GB99/01431

CLMS

P091652C

-25-

17. A storage device according to claim 10, wherein said storage device is a hard disk drive and the storage medium comprises at least one disk platter (2), and said loader means is provided in at least one reserved track of said at least one disk platter (2).

18. A storage device according to <sup>claim 1</sup> ~~any of claims 1 to 16~~, wherein the storage device is a hard disk drive (1).

10 19. A storage device according to claim 18, wherein the storage medium comprises at least one disk platter (2).

20. A storage device according to <sup>claim 1</sup> ~~any of claims 1 to 16~~, wherein the storage device is a solid state storage device.

15

21. A storage device according to <sup>claim 1</sup> ~~any of claims 1 to 16~~, wherein the storage device is an optical storage device.

22. A computer system incorporating a storage (1) device  
20 according to <sup>claim 1</sup> ~~any of claims 1 to 21~~.

23. A method of controlling access to and modification of information stored on a storage medium (2) of a storage device (1) for incorporation in a host computer system wherein the  
25 storage device comprises storage means (2, 4, 5) for storing information, intelligent means (7) for controlling the transfer of information to and from the storage means, and interfacing means (6) for interfacing the storage device (1) with the host computer system and via which information may be  
30 transferred to and from the storage means under the control of said intelligent means, and the storage means comprises: a storage medium (2); non-volatile read-only-memory (ROM) means (4) for storing firmware for controlling operation of the storage device; and volatile random-access-memory (RAM) means  
35 (5);

the method comprising the steps of:

AMENDED SHEET

22-05-2000

PCT/GB99/01431

CLMS

P09165PC

-26-

dividing the storage medium (2) into a plurality of non-overlapping partitions including a boot partition and at least one general partition, and dividing each said partition into a plurality of sectors, the boot partition including a boot  
5 sector containing code for use by the host computer system to perform operating system boot of the host computer system; providing supervising means in said storage means for operating said intelligent means (7) so as to protect information stored in the storage medium (2), said supervising  
10 means being incorporated at least partly as firmware which is stored in said non-volatile ROM means (4); storing in said storage means a host executable code segment for allowing user control of the supervising means via the host computer system and for controlling initiation of  
15 operating system boot in the host computer system; storing in the storage means loader means comprising host executable code for loading said code segment to the host computer system and causing the host computer system to execute the loaded code segment;  
20 said supervising firmware stored in the ROM means (4) being adapted to intercept any request for said boot sector, issued by the host computer system, and to supply said loader means in response to the request; and incorporating the storage device in a host computer system, and running the host  
25 computer system with the supervising means operating said intelligent means so as to protect information stored in the storage medium.

24. A method according to claim 23, wherein said supervising  
30 means is provided for allowing/restricting/prohibiting read/write operations upon the storage medium (2) depending upon whether information to be read from a sector or written to a sector is operating system information or user information, whether the sector is in the boot partition or in  
35 a general partition, and whether if the partition is a general partition the partition is active or inactive,

AMENDED SHEET

Printed: 25-05-2000

6

22-05-2000

PCT/GB99/01431

CLMS

P09165PC

-27-

said supervising means being adapted to intercept each interface request from the host computer system to said storage device (1);

and the loader means loads said code segment to a RAM of a central processing unit (CPU) of the host computer system for execution by the host computer system prior to operating system boot,

and the code segment, when executed, initiates a user interface procedure whereby a user may select a protection option from a selection of protection options; and whereupon, subsequent to a said selection having been made by the user, said code segment transfers a boot program from the boot sector of the storage medium (2) and causes the host computer system to execute said boot program so as to initiate operating system boot in the host computer system.

25. A method according to claim 24, wherein said selection of protection options includes the option, by entering a predetermined password, of setting the storage device in "unsupervised mode" whereby interface requests are not intercepted by the supervising means.

26. A method according to claim 25, wherein the selection also includes the option of setting the storage device (1) in "supervised" mode and designating at least one of said partitions a Write Many Recoverable (WMR) partition wherein, in use, if a write command is issued to overwrite any resident information stored in said at least one WMR partition by updated information, the updated information is written on the storage medium (2) in a location other than where any resident information is stored and a pointer to the updated information is provided so that the updated information can be accessed as required during the remainder of a session.

27. A method according to claim 26, further including storing a Sector Relocation Table (SRT) which contains the pointers

AMENDED SHEET

Printed: 25-05-2000

7

22-05-2000

PCT/GB99/01431

CLMS

P09165PC

-28-

associated with each said WMR partition in the volatile RAM means (5) of the storage device (1).

28. A method according to claim 25, further including the  
5 option of setting the storage device (1) in "supervised" mode  
and designating at least one of said partitions a Write Many  
Recoverable (WMR) partition wherein, in use, if a write  
command is issued to overwrite any information stored said at  
least one WMR partition, prior to undertaking said write  
10 command said information is copied and stored elsewhere on the  
storage medium (2) to be copied back to said WMR partition  
when required.

AMENDED SHEET